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## EUROPEAN PATENT APPLICATION

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(54) Multicontact connector for signal transmission.

(57) A multiple contact electrical connector for transmission of electrical signals therethrough comprises first and second matable connectors (1,2) each including signal contacts (5,5') and ground contacts (6,6') secured in dielectric housings (3,3') and arranged in a two-dimensional manner therein. The signal contacts (5,5') and the ground contacts (6,6') are arranged in the housings (3,3') in rows spaced at regular intervals with the ground contacts being shifted half a pitch relative to the signal contacts so that when the matable connectors are mated together, the engaged signal contacts (5,5') are surrounded by the engaged ground contacts (6,6').

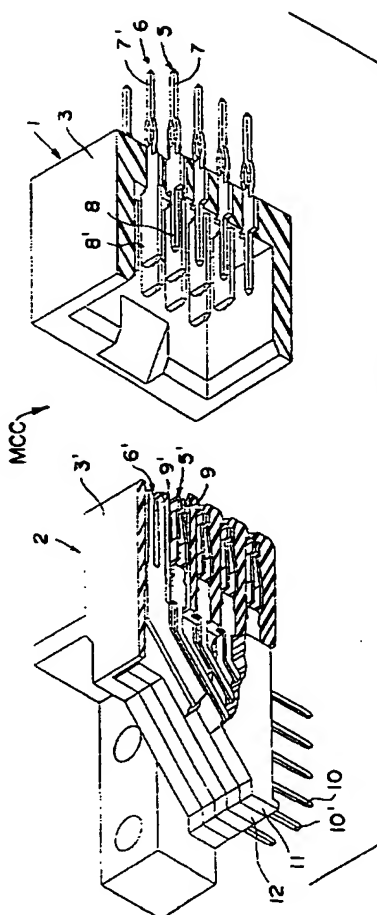


Figure 3

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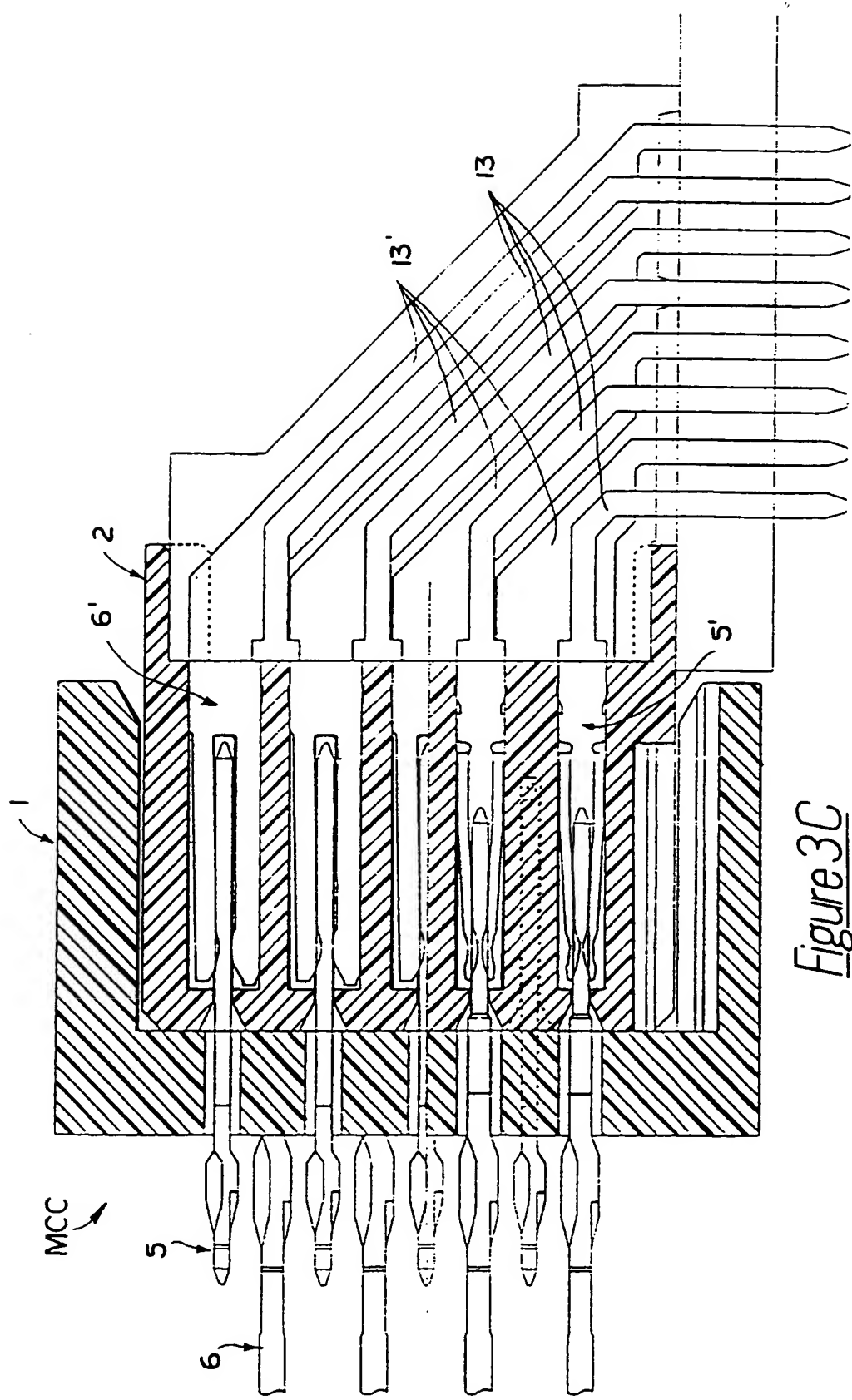


Figure 3C

This invention relates to multicontact electrical connectors for signal transmission having two halves, each one having a number of contacts for signal transmission and contacts for grounding arranged in a two-dimensional manner.

In many cases when it is required to interconnect processing equipment used for the integration and control of signals transmitted from a number of terminals for example, in the case of the interconnection of the signal integration and control equipment of a telephone circuit with similar equipment for signal integration and control of a telephone exchange, connectors including two halves each comprising a number of contacts for signal transmission and contacts for grounding arranged in a two-dimensional manner (referred to below as multicontact connectors for signal transmission) are used. The advantage presented by such multicontact connectors for signal transmission consists in the fact that they facilitate the increase in the number of signal circuits when required.

Since the connection of signal circuits involves the connection of the coaxial cables associated with each individual circuit, it is desirable that the grounding conductor shield the signal conductor. However, if such connections were made by means of connectors, to provide shielding for each individual contact would result in a substantial increase in the dimension of the connectors, to say nothing of the fact that it would also pose complex engineering problems.

Conventional multicontact connectors for signal transmission with a large number of contacts the engaging portions of which have the shape of, for example, a socket and a pin, or a male tab and female receptacle and which are arranged at a high density are known in the art.

However, the designers of conventional multicontact connectors for signal transmission have concentrated on increasing the density of signal contacts, while ignoring the arrangement of the grounding contacts. As a result, the cross-talk generated between the engaging portions of the contacts has been a wide spread phenomenon.

The purpose of this invention is to offer a multicontact connector for signal transmission in which the possibility of cross-talk is reduced due to the arrangement and configuration of the engagement portions of the signal contacts and grounding contacts.

In order to solve the problem mentioned above, the multicontact connector for signal transmission in accordance with this invention is characterized by the fact that it consists of two halves each one having signal contacts and grounding contacts arranged in rows at fixed intervals, with the signal contacts being placed in a zig-zag pattern relative to the grounding contacts at half the pitch of the latter; the grounding contacts of the connector halves have a roughly rec-

tangular cross section so that when engaged with a matching contact the cross section of the engaged portions of the contacts becomes shaped, for example, like a cross; and the signal contacts are practically surrounded by the adjacent grounding contacts when the mating halves of the connector are engaged.

The multicontact connector for signal transmission in accordance with this invention has a number of signal contacts and approximately the same number of grounding contacts with the grounding contacts having a cross section of such a configuration that it assumes the shape, for example, of a cross when the contact is engaged with the matching counterpart. The signal contacts and grounding contacts are arranged in such a fashion that the grounding contacts practically surround the signal contacts when the connector halves are engaged, thus effectively shielding them. As a result, the phenomenon of cross-talk between the signal contacts typical of conventional connectors is greatly reduced.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1A is a front elevational view of a first half of a multicontact connector for signal transmission in accordance with this invention.

FIGURE 1B is a top plan view of the connector of Figure 1A.

FIGURE 1C is a cross-sectional view of Figure 1A.

FIGURE 1D is an enlarged part frontal view of Figures 1A.

FIGURE 2A is a bottom plan view of a second half of the connector.

FIGURE 2B is a front elevational view of the connector of Figure 2A.

FIGURE 2C is a side view of Figure 2B.

FIGURE 3 is an exploded perspective view partly in section of the connector halves.

FIGURE 3A is a perspective view showing ground contacts in engagement.

FIGURE 3B is a frontal view showing engaged ground contacts surrounding engaged signal contacts.

FIGURE 3C is a cross-sectional view of the connector halves in matable engagement.

FIGURE 4 is a plan view showing the manufacturing stages of the signal and ground contacts of the second half of the connector.

FIGURES 5A and 5B are perspective views of a signal contact block.

FIGURES 6A and 6B are perspective views of a ground contact block.

A detailed explanation follows, of the multicontact connector for signal transmission in accordance with this invention based on its embodiments.

The multicontact connector MCC for signal trans-

mission in accordance with this invention includes a first half and a second half.

As can be seen from Figure 3, the first half 1 comprises an insulating housing 3 made in the shape of a box having a number of signal contacts 5 and an approximately similar number of grounding contacts 6 secured in a base of the box-shaped housing 3. All signal contacts 5 and grounding contacts 6 have terminal portions, 7 and 7' respectively, which are used to connect with the signal and grounding conductors of the printed circuit boards of the equipment on the one side of the base, and the contact portions 8 and 8' connected to such terminal portions, on the other side of the base within the box-shaped housing. As seen from Figures 1A through 1D, the signal contacts 5 and grounding contacts 6 are arranged at roughly fixed intervals in an overlapping pattern with a deviation of a half pitch. As can be clearly seen from Figure 3, the contact portion 8 of the signal contact 5 is configured as a pin, whereas the contact portion 8' of the grounding contact 6 is configured as a tab.

On the other hand, the second half 2 of the connector MCC, as shown explicitly in Figure 3, includes the insulating housing 3' which contains a number of signal contacts 5' and approximately the same number of grounding contacts 6'. All signal contacts 5' and grounding contacts 6' have receptacle contact portions, 9 and 9', for the receipt of contact portions 8, 8' of the signal contacts 5 and grounding contacts 6 of the first half 1 of the connector. At the other end of the contacts 5', 6' the terminal portions 10 and 10' are connected to the receptacle contact portions 9, 9'. The terminal portions 10 and 10' connect the signal and grounding conductors of the printed boards of the equipment on the other side. All signal contacts 5 and grounding contacts 6 of the first half 1 of the connector, and signal contacts 5' and grounding contacts 6' of the second half 2 of the connector are arranged at set intervals and are shifted at a half pitch relative to each other. In addition, as can be clearly seen from Figure 3, the receptacle contact portions 9 of the signal contacts 5' exhibit a roughly C-shaped configuration, whereas the receptacle contact portions 9' of the grounding contacts 6' have a fork shape.

When the first half 1 and the second half 2 of the connector MCC are mated, as can be seen from Figure 3A, the contact tabs 8' of the grounding contacts 6 of the first half 1 and the receptacle contact portions 9' of the grounding contacts 6' of the second half 2 are directly connected with each other. At the same time, the contact portions 8 of the signal contacts 5 of the first half 1 and the receptacle contact portions 9 of the signal contacts 5' of the second half become mutually engaged.

In this state, as shown in Figures 3B and 3C, the direct engagement of the contact tabs 8' of the grounding contacts 6 of the first half 1 with the grounding contact 6' of the second half 2 (referred to below

as "the engagement of the grounding contacts"), and the engagement of the contact pins 8 of the signal contacts 5 of the first half 1 of the connector with the receptacle contact portions 9 of the signal contacts 5' of the second half 2 (referred to below as "the engagement of the signal contacts") results in such a positional relationship of the entire set of engaged contacts that the signal contacts are surrounded by grounding contacts. Moreover, as shown in Figure 3, the engagement of contact tabs 8' and contact portions 9 result in a cross-shape configuration.

Therefore, the engaged portions of the signal contacts are virtually shielded by the engaged portions of the grounding contacts, thus reducing considerably the eventuality of the cross-talk which is generated in the conventional connectors.

In what follows, additional features specific of both the signal contacts 5' and grounding contacts 6' of the second half 2 of the connector in accordance with this embodiment will be explained which are generated by the manufacturing method and configuration thereof.

Figure 4 represents a plan view displaying the various stages in the process of manufacturing the signal and grounding contacts of the second half of the connector; Figures 5A and 5B are perspective views of a signal contact block or module; and Figures 6A and 6B are perspective views of a grounding contact block or module.

As shown in Figure 4, all signal contacts 5' and grounding contacts 6' of the second half 2 of the connector in accordance with this embodiment, are formed by stamping from a sheet of conductive metal 4. The signal contacts 5' and the grounding contacts 6' are stamped in units of four contacts, whereas the portion 14 shown by a dotted line is subject to insert-molding thereby molding a suitable dielectric material onto connecting sections 13, 13'. The signal contact blocks 11 and the grounding contact blocks 12 are formed in stages as shown in Figures 5A through 6B. Then, the signal contact blocks 11 and the grounding contact blocks 12 are inserted alternately in the insulating housing 3' as shown in Figure 3.

This insert-molding process of the signal contacts 5' and grounding contacts 6' by blocks of four units yields the following result.

In the first place, knowing that the internal impedance of the signal contacts 5' can be altered by altering the dielectric constant of the resin used in insert molding the impedance will be easily brought to a predetermined value. By adjusting the impedance, the noise can be reduced. In addition, since all the signal contacts 5' and grounding contacts 6' have dielectric material insertmolded thereon, the intervals between the contacts can be made with great precision, thus providing for a highly-uniform spacing and impedance of the contacts. Since the contacts are produced in blocks, the handling and assembly of the

second half 2 of the connector is greatly facilitated.

As Figure 4 shows in this embodiment, the oblique connecting sections 13' located between the receptacle contact portions 9, and the terminal sections 10' of the grounding contacts 6' are wider than the connecting sections 13 of the signal contacts 5'. In addition, when the signal contact blocks 11 and the grounding contact blocks 12 are alternately inserted into the insulating housing 3', connecting sections 13' of the signal contacts 5' will be between the connecting sections 13' of the grounding contacts 6' as shown in Figures 3 and 3C.

Thanks to this arrangement, the signal contacts 5' are shielded by the grounding contacts 6' in the area of their connecting sections as well, thus again reducing the possibility of cross-talk generation. In addition, due to the fact that the connecting sections 13' of the grounding contacts 6' are wide, the distance between the terminal sections 10' and the receptacle contact portions 9' is shortened, thereby preventing any potential variations in the grounding contacts 6'.

The above descriptions concerning the details and effects of the multiplecontact connector on signal transmission in accordance with this invention have been based on the disclosed embodiment only. However, the multiplecontact connectors for signal transmission in accordance with this invention are not limited only to this embodiment.

For example, as regards the signal contacts 5' and the grounding contacts 6' of the second half 2 of the connector in accordance with the above embodiment, the emphasis is placed on the engaging sections of the signal contacts and grounding contacts of the first and second halves, but this invention is not limited to this arrangement only.

In addition, in the above embodiment, the contact portion 8' of grounding contact 6 of the first half 1 of the connector is made in the shape of a tab and the receptacle contact portion 9' of the grounding contact 6' of the second half 2 of the connector is made in the shape of a fork, but these configurations are interchangeable.

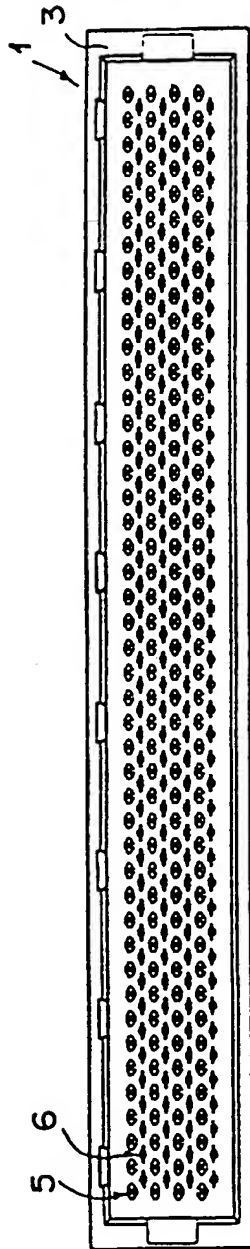
Therefore, the multiple contact connectors for signal transmission in accordance with this invention can be executed with various modifications without sacrificing its effect.

## Claims

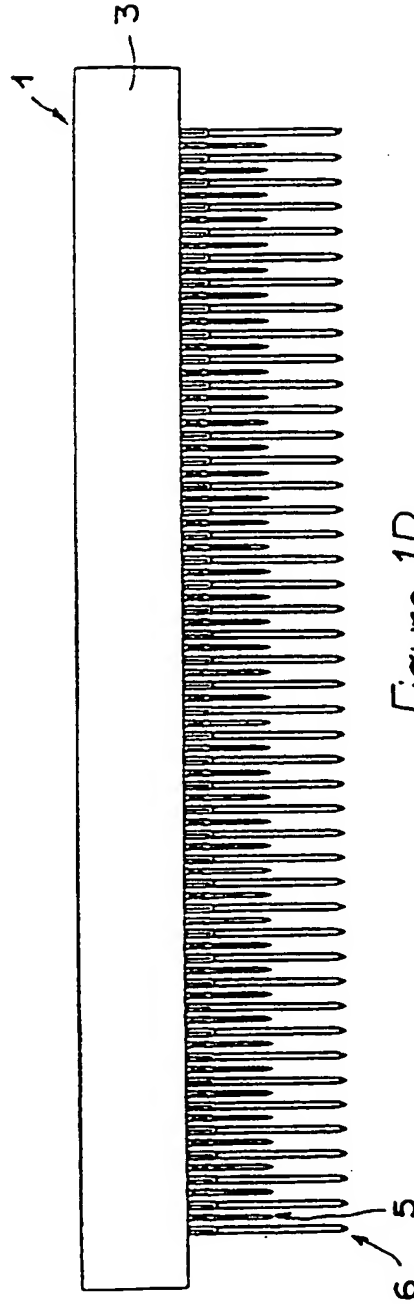
1. A multiple contact electrical connector for transmission of electrical signals therethrough comprising first and second matable connectors (1,2) each including signal contacts (5,5') and ground contacts (6,6') secured in dielectric housings (3,3') and arranged in a two-dimensional manner therein, characterized in that:  
said signal contacts (5,5') and said ground

contacts (6,6') are arranged in said housings (3,3') in rows spaced at regular intervals with said ground contacts being shifted half a pitch relative to said signal contacts (5,5') so that when the matable connectors are mated together, the engaged signal contacts (5,5') are surrounded by the engaged ground contacts (6,6').

2. A multiple contact electrical connector as claimed in claim 1, characterized in that said signal contacts (5) in said dielectric housing (3) are pin contacts and said signal contacts (5') in said dielectric housing (3') are C-shaped receptacle contacts.
3. A multiple contact electrical connector as claimed in claim 1, characterized in that said ground contacts (6) in said dielectric housing (3) are tab contacts and said ground contacts (6') in said dielectric housing (3') are fork-shaped receptacle contacts.
4. A multiple contact electrical connector as claimed in claim 1, characterized in that the rows of the signal contacts (5,5') are staggered with respect to the ground contacts (6,6').
5. A multiple contact electrical connector as claimed in claim 1, characterized in that said signal contacts (5) and said ground contacts (6) in said housing (3) are secured in a base of said housing (3).
6. A multiple contact electrical connector as claimed in claim 1, characterized in that said signal contacts (5') and said ground contacts (6') have receptacle contact portions (9,9') and termination sections (10,10') with connecting sections (13,13') extending between the receptacle contact portions and the termination sections, and a dielectric material is secured onto and covering said connecting sections (13,13').
7. A multiple contact electrical connector as claimed in claim 6, characterized in that said connecting sections (13') of said ground contacts (6') are wider than said connecting sections (13) of said signal contacts (5').



*Figure 1A*



*Figure 1B*

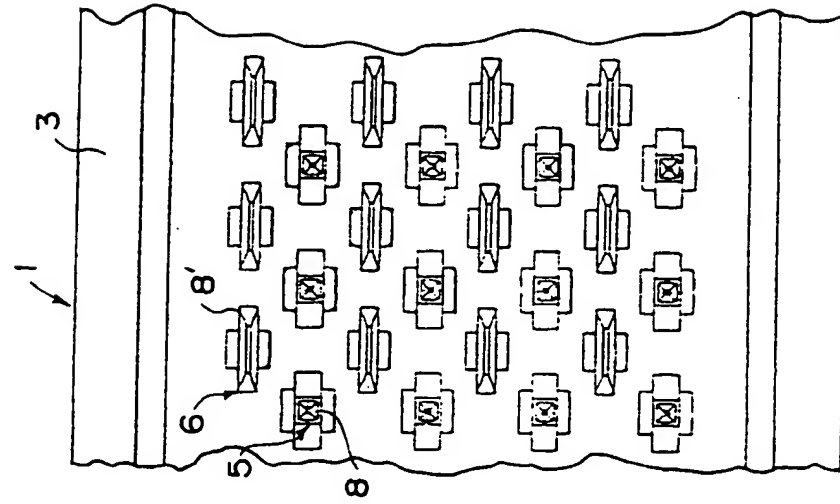


Figure 1D

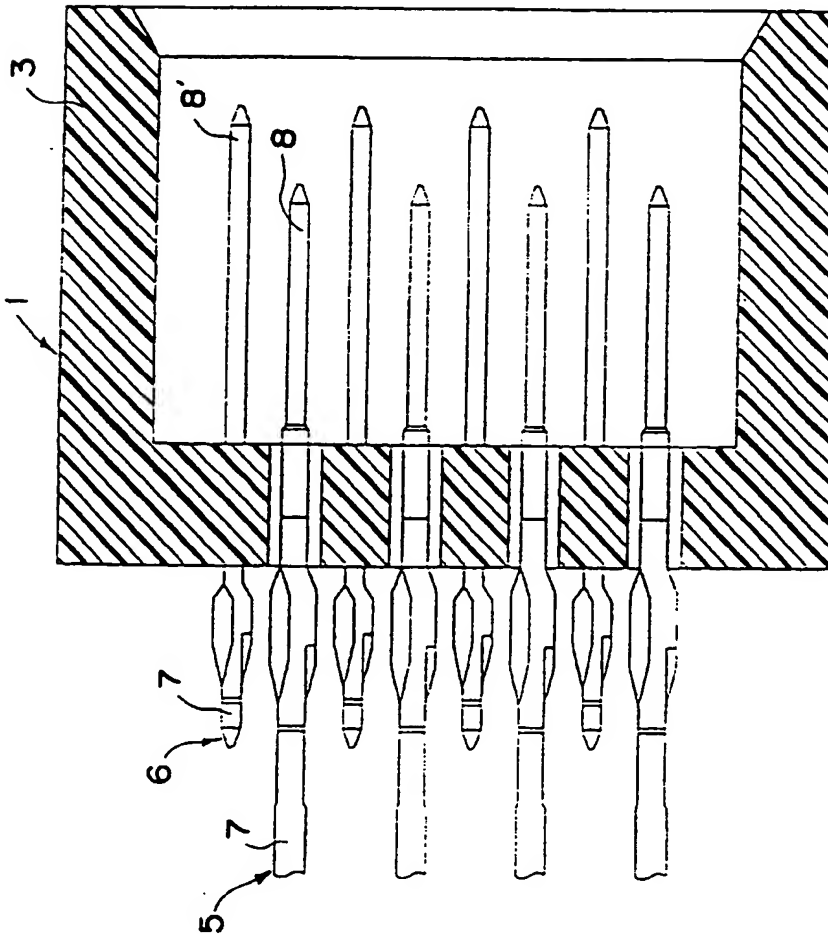


Figure 1C



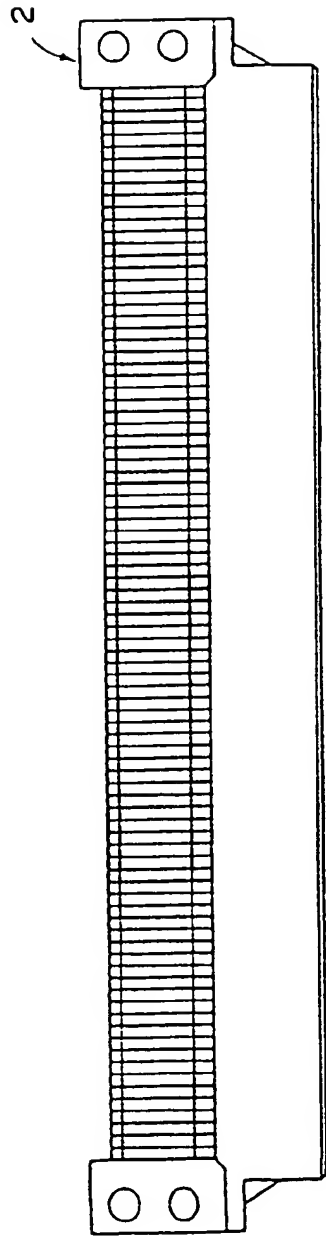


Figure 2A

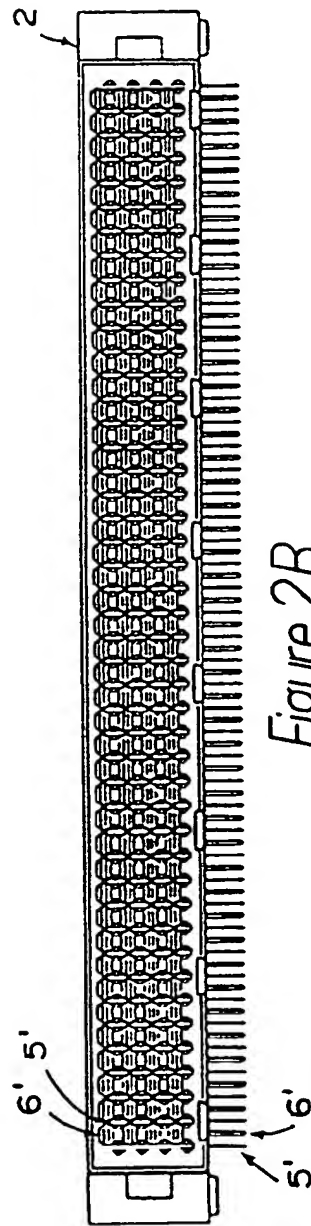


Figure 2B

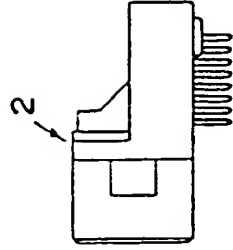


Figure 2C

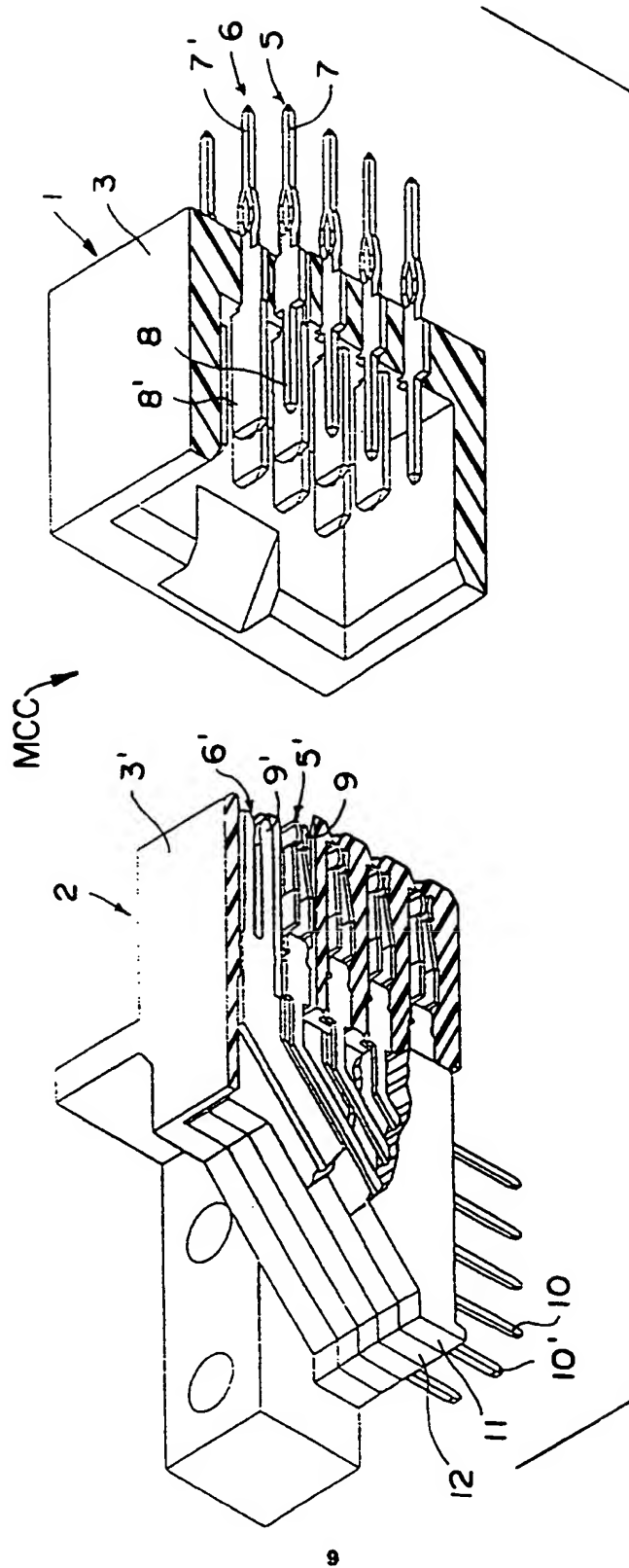


Figure 3

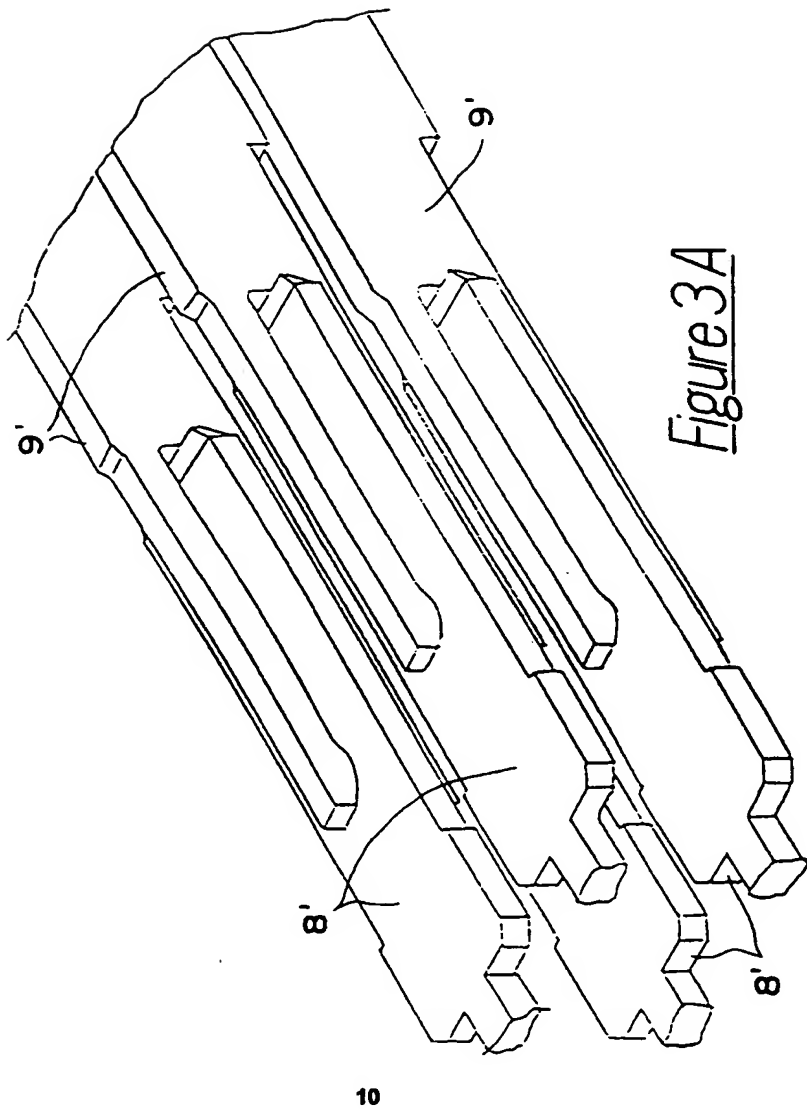


Figure 3A

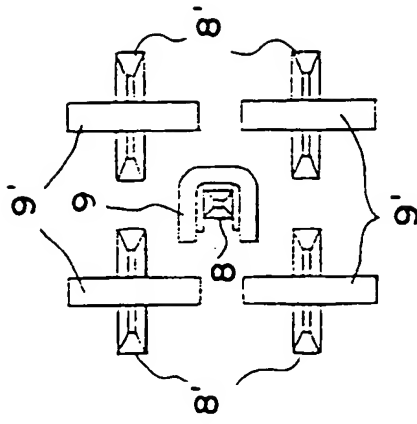


Figure 3B

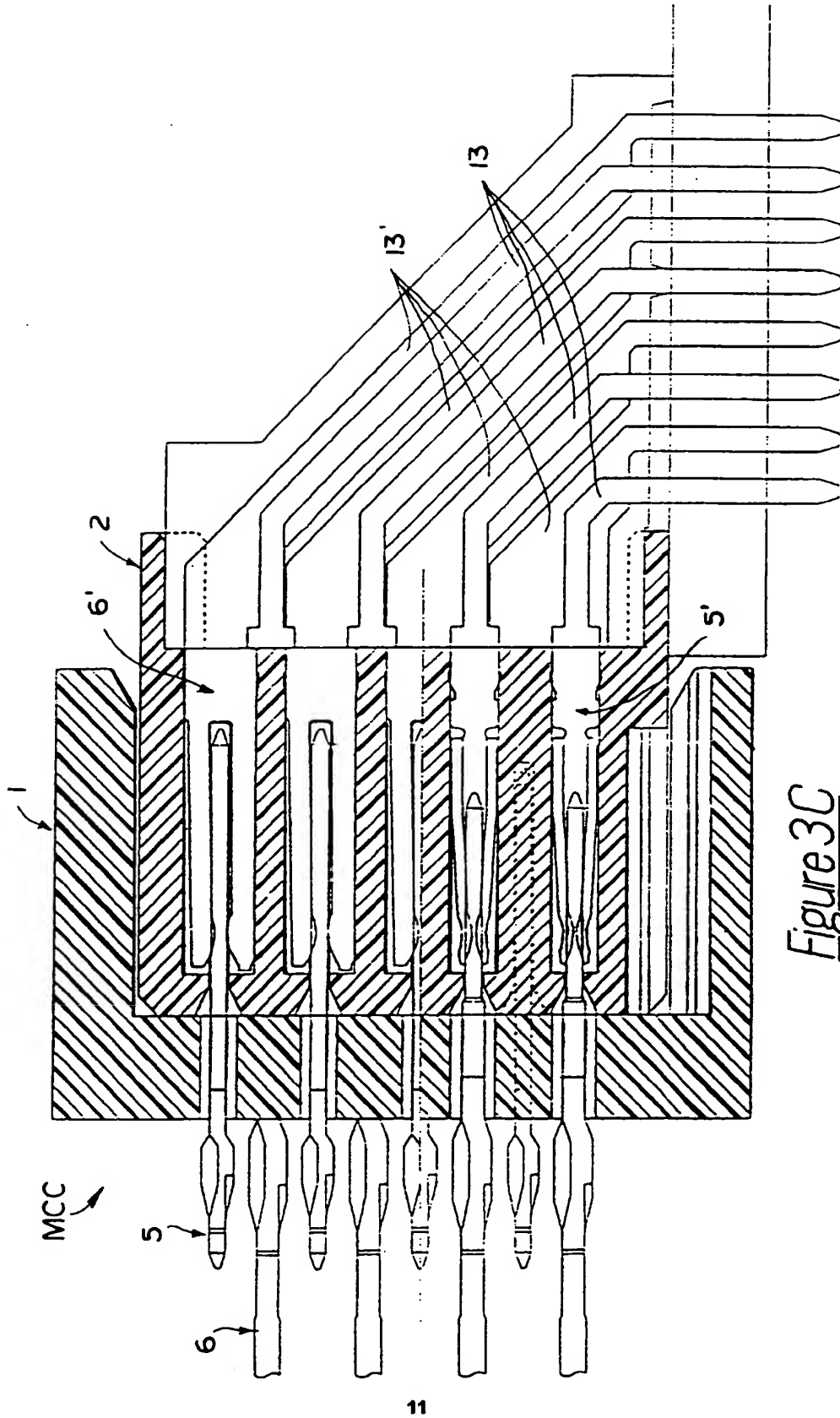


Figure 3C

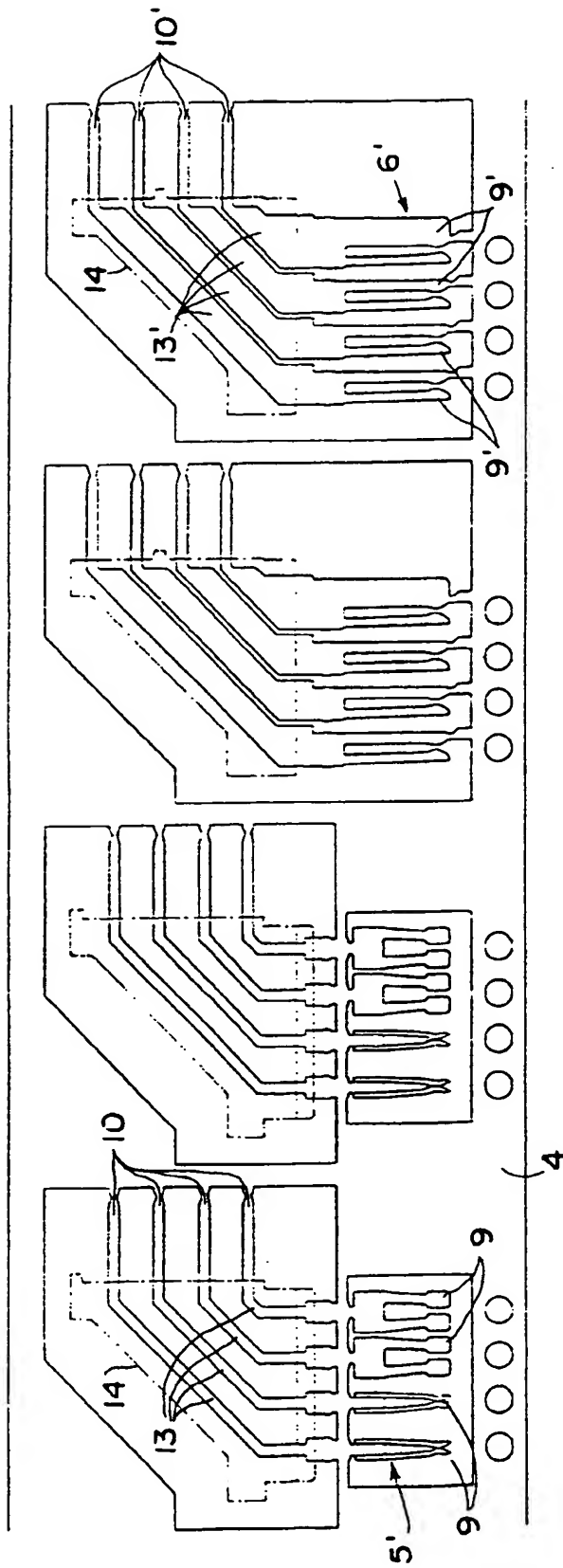


Figure 4

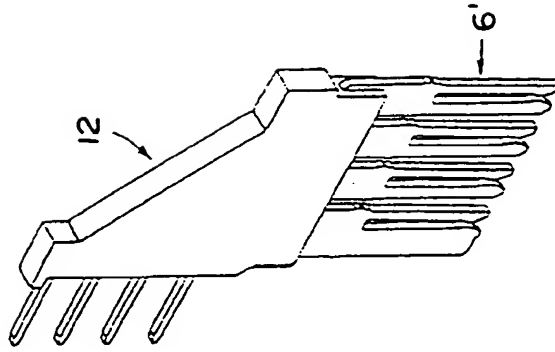


Figure 6B

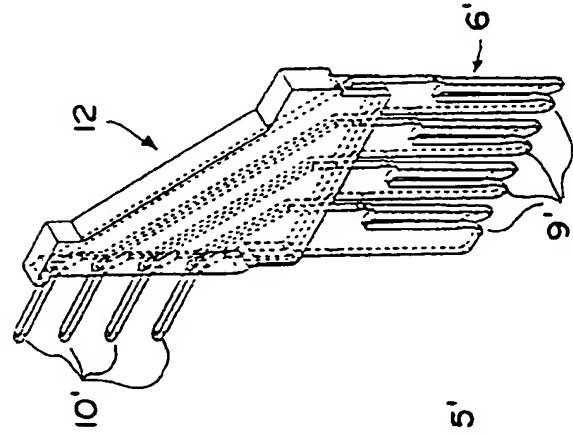


Figure 6A

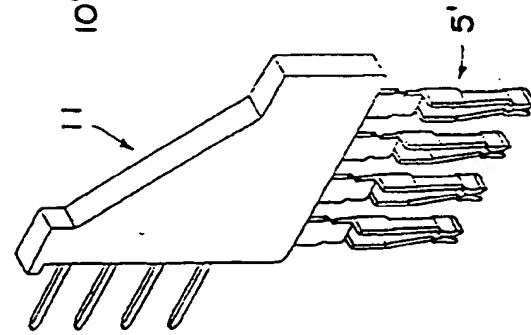


Figure 5B

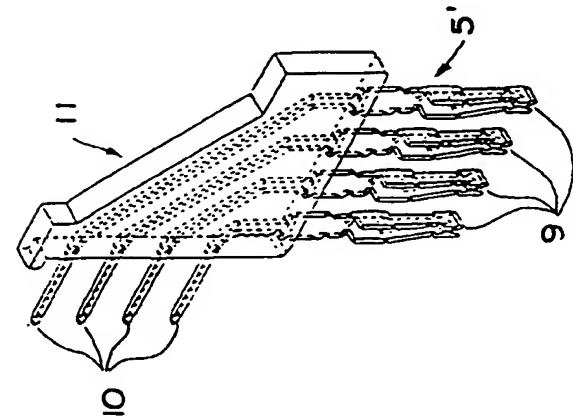


Figure 5A



European Patent  
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# EUROPEAN SEARCH REPORT

Application Number

EP 91 31 0510

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |  |   |
|--|---|--|---|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim                                    | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| X  | DE-A-3 511 344 (SIEMENS AG.)<br>* claims 1-4; figure 1 *  | 1  | H01R23/68                                     |
| A  | PATENT ABSTRACTS OF JAPAN<br>vol. 014, no. 213 (E-092) 7 May 1990<br>& JP-A-20 049 365 ( NEC CORP. ) 19 February 1990<br>* abstract * | 1  |   |
| A  | US-A-4 917 616 (DEMLER, JR. ET AL.)<br>* column 2, line 2 - line 16; figure 4A *  | 1-4  |   |
|  |   |  | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|  |   |  | H01R  |
| The present search report has been drawn up for all claims   |   |  |   |
| Place of search<br>THE HAGUE   |   | Date of completion of the search<br>13 FEBRUARY 1992 | Searcher<br>HORAK A. L.                       |
| <p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone<br/> Y : particularly relevant if combined with another document of the same category<br/> A : technological background<br/> O : non-written disclosure<br/> P : intermediate document</p> <p>T : theory or principle underlying the invention<br/> E : earlier patent document, not published on, or after the filing date<br/> D : document cited in the application<br/> I : document cited for other reasons<br/> &amp; : member of the same patent family, corresponding document</p> |   |  |   |

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